Tuberculosis in humans and animals: are we a threat to each other?

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It was no coincidence that a meeting on the problem of tuberculosis in humans and animals, and the potential mutual threat we are to each other, was held in the last week of the Department for Environment, Food and Rural Affairs consultation on badger culling. The same day an A4 sized picture of a badger appeared on the front of a daily broadsheet.

Historically the link between animal and human tuberculosis (TB) has always been strong.

From the early 1800s TB has been described in cattle in slaughterhouses. In 1865 Villemin showed that infected tuberculous material could be injected from one species to another to cause disease and, in 1882, Koch pointed out that there was a danger that TB could be transmitted from animals to humans. In 1902 Ravenel demonstrated *Mycobacterium bovis* in a child with tuberculous meningitis. Yet it was not until 1929 that the danger of animal to human transmission of TB received Government debate.

In Victorian times most of a city's milk supply would come from cows living in sheds within the city limits, increasing the risk of direct spread of TB, either by milk or airborne infection, to city dwellers. Even today in developing countries 15% of food is likely to be produced within cities.

It was likely that TB transmitted from infected milk to humans was a major cause of morbidity and mortality from Victorian times up to about the Second World War.[1,2]

During the 1930s tuberculin testing was introduced in cattle in the UK; 40% were found to be reactors. With the introduction of pasteurization, initially to prolong the shelf life of milk, came the full control of the transmission of bovine disease to humans. At that time bovine TB was a major source of disease to humans but between 1931 and 37 deaths from bovine TB declined from 6.1% to 5.6% of the total.

Today TB in animals is a word wide problem. In England and Wales it is increasing rapidly. The same strains of *M. bovis* demonstrated by spoligotyping have been found in cattle and badgers living in close confines. Infection in cattle leads to economic harm to agriculture as animals cannot be traded. The clinical and economic importance of TB in cattle is as great as for bovine spongiform encephalitis and foot and mouth disease. Fatality from TB can result directly in cattle and infection means slaughter. In this situation a farmer's insurance may be terminated, with resulting loss of earnings and bankruptcy.

The main means of spread between cattle is probably due to translocation of cattle as those with infection are moved to a non-infected heard. The spread to and from wildlife is also likely to be important.

Though human TB had increased by 20% in England and Wales, since 1987 the geographical distribution of human TB is very different from the distribution of TB in cattle.[3]

Disease in humans from *M. bovis* has occurred in no more than 25 cases a year for the last 5 years. As most of disease is in the older age groups it is likely that infection had occurred sometime, perhaps decades, in the past. The implication is that there is no current cattle to human transmission. However, cases in younger patients in the UK do occur in the foreign born, which suggests that cattle to human transmission could be a problem in some developing countries.

There have been a handful of documented cases where infection of a human had probably arisen by airborne spread from cattle. (J Watson, F Drobniweski, personal communication).

TB in cattle is a human health issue. If TB is being transmitted from wildlife to cattle, then this too is a human health issue. Wildlife, farm animals, pets, food and milk all pose a potential threat to our health.

The conflict in control is between the cost of an eradication programme and the safety of less than complete eradication in European states. A number of new problems are now presenting themselves such as the importation of exotic pets which are not covered by current law. [4]

Internationally, TB is a world threat.[5] A large number of cattle have TB in the developing world where there are neither schemes for compensation nor government policies of eradication. Bovine TB is probably increasing in Africa as a result of farming policies allowing free movement of cattle.

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In a study of 967 cows carried out in Nigeria, 14% were found to be tuberculin positive. Of these, 12% had infected milk as shown by culture positivity for *M. bovis* and 13% diseased tissues at slaughter. (Aishatu Abubakr, personal communication.)

Until now evidence of infection in cattle has depended on the old fashioned tuberculin skin test. The new gamma-interferon blood tests which had been pioneered in cattle can detect infection earlier than the skin test. Used together they could form a more sensitive test for infection than either alone.[6]

Vaccines offer the best prospect of control but at an estimated cost of $1.8 billion to develop. The plan is to have a vaccine ready by 2015. The human vaccine development would provide the best hope for a cattle vaccine which might also be used on wildlife. This might have application to the badger population to prevent spread to cattle.[7]

Though control of TB in cattle is a public health measure, the stark reality is that only 22 cases of *M. bovis* in humans had been identified in the UK in 2004 yet 30 000 cattle had been slaughtered to prevent the risk to humans.

The cost of bovine TB in cattle has been rising steeply. In 1986, 88 herds had been found to carry the infection. By 1996 the number had risen to 476, by 2000 to 1044 and by 2005 there were 5539 infected herds. In the latest year 30 000 cattle had been slaughtered. Against this it had been suggested that a total of 12 000 badgers be culled over the next 10 years.

Evidence form post mortems done on road kill badgers showed that the incidence had increased from a 5% infection rate in 1972 to 15% in 2002–2004. In the light of an infection rate of up to 38% found in culled badgers, this was probably an underestimate.

Eradication should be the aim. To see what had gone wrong with TB control in cattle since its nadir in the 1970s it is necessary to ask what is being done differently now compared with then. There are four areas to examine: increase in herd size, increase in movement of cattle, an increase in the badger population and the absence of control measures for wildlife. Special herds which were entirely isolated from other cattle are being infected by probable transmission from wildlife.[8] It is necessary to apply the same rigorous control to wildlife as is currently being applied to cattle. And this of necessity would include a badger cull.

Though animals with TB pose some risk to humans, within the confines of the UK this is probably very small indeed. Evidence suggests that no more than a handful of humans may have acquired disease from animals in the last decade; *M. bovis* having been transmitted by airborne spread. In contrast, spread from animals to humans in developing countries remains a very real danger, mostly from infected milk. This seems to be a danger, which is being entirely ignored.

Within the UK, the real battle in TB control in the animal world is in transmission from wildlife, principally badgers, to cattle. Here there is strong circumstantial evidence of spread and a measure to reduce infection in wild life by a badger cull is now a realistic proposition.

Note This paper is based on a meeting held at The Royal Society of Medicine, London, 7 March 2006, in conjunction with TB Alert and the Liverpool Medical Institution.

Competing interests None declared.

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